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**Synthesis, Thermal Stability and Structural Transition of Cubic SnS Nanoparticles**

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**Abstract**

Recently identified cubic polymorph of SnS (SnS-CUB) is a promising low-cost material for solar cell applications. We report on the thermal stability, structural and optical properties of SnS-CUB nanoparticles. The average crystallite size of cubic SnS nanoparticles synthesized by wet chemical method at 20 °C is about 34.9 nm and unit cell lattice parameter a = 11.59 Å. We found that cubic phase remained structurally stable up to 400 °C even though sulfur is partially re-evaporated. The sample annealed at 450 °C contains both cubic and orthorhombic phases. When the annealing temperature is increased to 500 °C, the sample completely transforms to orthorhombic structure. Raman spectroscopy showed the formation of minor secondary phases Sn2S3 and SnO2 at temperatures ≥500 °C. Three distinct regions of weight loss are observed in thermogravimetric curve (TGA) of cubic SnS nanoparticles; around 300 °C, 600 °C and 800 °C. Weight loss of 10% observed near 600 °C was due to rapid re-evaporation of sulfur from SnS. Annealing at 500 °C decreases the direct optical bandgap value 1.68 eV–1.3 eV (direct), 1.0 eV (indirect) is also an indication of the structural transition of SnS-CUB to orthorhombic SnS. Cubic SnS nanoparticles were strongly absorbing light photons in the visible wavelength range of 400 nm–700 nm. The orthorhombic SnS with an indirect bandgap of 1 eV has extended the absorption edge to 1000 nm. By combining both cubic and orthorhombic SnS, the absorption can be extended to a wide wavelength range.

**Keywords:**

Cubic SnS, nanoparticles, TGA, Thermal stability, Optical properties.

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